Quantified evidence in Science for Policy. Notes for the talk at DESTINATION EARTH INITIATIVE, THE LAUNCH EVENT, 30 March 2022

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Most of my professional life I studied methods to test the quality of models, using a combination of mathematical and sociological tools. A two-page manifesto in the journal *Nature* summarizes the approach. This premise is to articulate my position toward Destination Earth and the concept of Digital Twin, with the important caveat that I have a limited experience of those, and that my view is that of an outsider.

Zooming on Destination Earth using the lenses of the manifesto just mentioned, one is encouraged to identify the 'frame' where a given modelling exercise takes place, including the set of spoken or unspoken assumptions that feed into the construction of the mathematical artifact.

Destination Earth strategy claims to aim at building a 'System of systems'. It appears to me as inspired by a metaphor of nature as a machine. My view is that of nature as an open system of nested and interdependent systems. The idea that a continuous stream of data improves human understanding of this system is predicated on the underlying models being capable of such an assimilation, which is a courageous assumption – the manifesto uses the Greek term *hubris* (over-confidence, to the point of defying gods) and warns modellers against its dangers. The higher the number of interconnected models, the less one may detect inadequacy in one or several of them. To make an example of which I have experience, will digital twins help assess water supply and food security as claimed? What if models and data for irrigation demand are still immature?

Do we truly believe that in the data assimilation it is possible "incorporating human systems, also as part of the prediction problem"? My personal view – put boldly, is that the production of fantastic numbers has gone too far – if we believe that we can compute the social cost of carbon by averaging till the year 2300 then we can believe anything.

Here the recipes of the manifesto – in terms of carefully appreciating the frames, the uncertainties, the ignorance, the unintended effects and plain ignorance, may come handy.

Destination Earth embraces the 'datafication value chain', and a 'data driven economy', where software platforms become 'engines of innovation'. A word of caution here would point to a rich and blooming literature of sociology of quantification that sees into the so-called 'governance by numbers' dangers for the democratic process and the rule of law.

A successful Destination Earth will "bring together data owners, data analytics companies, skilled data professionals, cloud service providers, companies from the user industries, venture capitalists, entrepreneurs, research institutes and universities". This is clearly a 'business ecosystem' based on a 'software ecosystem', to use the words of the proponents. What role – if any, for lay citizens? What are the consequence of discounting this role?

One might object that the measuring of physical variables is objective, not in need of a democratic step of deliberation. I disagree, in that the care of the environment is also a philosophical, ethical, legal, and ultimately political matter. The recent discussion of what source of energy counts as renewable in the European Union is a clear example. Quantification, of any kind, affects the real that is measured, at times providing justification for a preconceived policy. For this reason, the quality of a quantification needs a double process of verification, technical as well as ethical, and the fairness of a quantification regime cannot be decided by the centre. In this respect, the analysis must start from the excluded, the invisible, or those whose voice in unheard – this is what sociologists mean when they call for technologies of humility. One should also be careful that the digital twin does not become the occasion for a process of displacement – where one is encouraged to look at the model instead of

looking at the real, at the local, where ecological damage and injustice are produced. What is the point of measuring the extension of a forest when its wood is burned as renewable energy?

As noted by some of the proponents, "including the human dimension means including non-technocratic approaches from social sciences to ensure that the end-user uptake becomes reality and will be effective." This inclusion of the human (humanistic) dimension is important – even the fantastic one-to-one map of the kingdom or the earth-sized computers imagined by novelists are perhaps not totally irrelevant to this discussion.

Sources

Irrigation

(Puy, Lo Piano, and Saltelli 2020; Puy et al. 2021; 2022).

Manifesto

(Saltelli et al. 2020)

Material of Destination Earth

(Nativi, Mazzetti, and Craglia 2021; Bauer, Stevens, and Hazeleger 2021)

Governing by numbers

(Mennicken and Espeland 2019; Salais 2022; Supiot 2017; Zuboff 2019)

Ecological take from social studies of science and technology

(Jasanoff 2007; Funtowicz and Ravetz 1994; Rayner 2012)

Maps and computers of the world

(Borges 1946; Douglas 1979)

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